

INTERIM GEOLOGIC MAP OF THE CLEAR CREEK MOUNTAIN QUADRANGLE, KANE COUNTY, UTAH

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CLEAR CREEK MOUNTAIN QUADRANGLE

Summary of Geologic Mapping

This interim geologic map of the Clear Creek Mountain quadrangle represents the results of part of a project by the Utah Geological Survey to map eight 7.5-minute quadrangles covering and adjacent to Zion National Park at a scale of 1:24,000. The other quadrangles being mapped are Cogswell Point, Kolob Arch, Kolob Reservoir, Springdale East, Springdale West, Temple of Sinawava, and The Guardian Angels. Partial funding for this project is being provided by the National Park Service.

Bedrock units on the Clear Creek Mountain quadrangle comprise sedimentary strata ranging in age from Early Jurassic (Navajo Sandstone) to Late Cretaceous (Straight Cliffs Formation), and were deposited in a variety of terrestrial to marine environments (eolian dune field, alluvial plain, lagoon/bay, sabkha, tidal flat, foreshore, shoreface, offshore). Two laterally persistent coal beds are present in the Upper Cretaceous Dakota Formation, and the conglomerate member of the Lower Cretaceous Cedar Mountain(?) Formation is locally uraniferous. The Paria River Member of the Middle Jurassic Carmel Formation contains a relatively thick alabaster bed, and septarian nodules can be found in the Upper Cretaceous Tropic Shale. The most significant Quaternary deposits are large, deep-seated landslides that typically involve the Tropic, Dakota, and Cedar Mountain(?) Formations. A reactivated portion of the Coal Hill landslide complex is crossed by Utah Highway 9; slow, continual movement of this landslide necessitates annual repairs to the road surface.

Two significant differences in bedrock mapping exist between this interim map and previous geologic maps of the area (see Sources of Geologic Mapping). First, the coal-bearing sequence of brackish-water, swamp/marsh, and shallow-marine deposits between the upper coal zone of the Dakota Formation and “sugarledge sandstone” is mapped as the upper member of the Dakota Formation rather than Tropic Shale. The Tropic Shale is mapped as the interbedded marine shales and sandstones that overlie the highest coal bed immediately above the “sugarledge sandstone.” Second, the basal Cretaceous sequence below the lower coal zone of the Dakota Formation is mapped as Cedar Mountain(?) Formation rather than Dakota Formation. Palynological analyses indicate an Early Cretaceous age (no younger than Albian) for this unit of mudstone and underlying conglomerate and sandstone. However, results of radiometric dating of an ash bed in this unit are pending, and more work is needed to establish lithologic correlations and regional stratigraphic relations, hence the queried designation.

SOURCES OF GEOLOGIC MAPPING

CLEAR CREEK MOUNTAIN QUADRANGLE

Cashion, W.B., 1961, Geology and fuels resources of the Orderville-Glendale area, Kane County, Utah: U.S. Geological Survey Coal Investigations Map C-49, scale 1:62,500.

----1967, Geologic map of the south flank of the Markagunt Plateau, northwest Kane County, Utah: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-494, scale 1:62,500.

Doelling, H.H., and Davis, F.D., 1989, The geology of Kane County, Utah - Geology, mineral resources, geologic hazards: Utah Geological and Mineral Survey Map 121, scale 1:100,000 (accompanies Utah Geological and Mineral Survey Bulletin 124).

Gregory, H.E., 1950, Geology and geography of the Zion Park region, Utah and Arizona: U.S. Geological Survey Professional Paper 220, 200 p.

Sable, E.G., and Hereford, Richard, 1990, Preliminary geologic map of the Kanab 30- by 60-minute quadrangle, Utah and Arizona: U.S. Geological Survey Open-File Report OF 90-542, scale 1:100,000.

DESCRIPTION OF MAP UNITS

CLEAR CREEK MOUNTAIN QUADRANGLE

Quaternary

- Qaly Younger alluvium (Holocene) -- Fine to medium-grained, pale-orange to yellowish-brown sand with subangular to subrounded gravel, cobbles, and small boulders of sandstone, limestone, and gypsum, and minor silt and clay. Comprises modern channel deposits; probably less than 10 feet (3 m) thick.
- Qalo Older alluvium (Holocene) -- Stratified, fine to coarse-grained, pale-orange, yellowish-brown, and gray sand with silt, clay, and scattered, angular to rounded gravel and cobbles of sandstone, limestone, and gypsum. Forms incised surfaces generally 15 to 20 feet (5-6 m) above modern channels; as much as 80 feet (24 m) thick along Meadow Creek.
- Qai Fine-grained alluvium (Holocene) -- Thin-bedded silt with clay and fine sand; gray to brown, locally iron-oxide stained. Deposited along low-gradient stream reaches. Thickness probably less than 20 feet (6 m).
- Qafm Middle alluvial-fan deposits (Holocene) -- Non-stratified, reddish-brown, poorly sorted sand and pebble to cobble gravel with silt and scattered boulders; subangular to angular clasts of sandstone, limestone, and gypsum. Deposits are graded to older alluvial surfaces (Qalo) and are incised by modern stream channels. Thickness probably less than 20 feet (6 m). Note: young (Qafy) and old (Qafo) alluvial-fan deposits are present on other quadrangles in the Zion National Park area, but are not mapped on this quadrangle.
- Qae Mixed alluvial and eolian deposits (Holocene to upper Pleistocene?) -- Locally derived, unsorted, fine-grained sand and silt with scattered, subangular to angular gravel. Deposited in shallow topographic depressions by slope wash and wind. Thickness less than 5 feet (1.5 m).
- Qac Mixed alluvium and colluvium (Holocene to Pleistocene) -- Sand, silt, and clay with scattered, subangular to angular gravel and cobbles; brown to gray, locally poorly stratified. Deposited in minor drainages and topographic depressions primarily by slope wash and creep. Typically incised by modern ephemeral stream channels. Thickness less than 25 feet (8 m).
- Qc Colluvium (Holocene to Pleistocene) -- Unsorted, nonstratified sand and silt with subangular to angular gravel and cobbles. Color and clast composition vary with parent material. Deposited primarily by creep and slope wash. Estimated to be less than 5 feet (1.5 m) thick.

- Qmtc Mixed talus and colluvium (Holocene to Pleistocene) -- Angular sandstone cobbles and boulders derived from the Straight Cliffs Formation embedded in a nonstratified matrix of sand with silt and angular to subangular gravel; deposited by combination of rock fall, creep, and slope wash. Generally less than 15 feet (4.5 m) thick.
- Qmt Talus (Holocene to Pleistocene) -- Primarily nonsorted, coarse, angular blocks deposited on steep slopes and derived from ledges and cliffs immediately upslope; locally includes undifferentiated colluvium. Generally less than 15 feet (4.5 m) thick.
- Qmsh Historical mass-movement deposits (slides and slumps) (Holocene) -- Masses of rock and unconsolidated material that have undergone translational and/or rotational downslope movement. Include zones of highly disturbed material, especially at landslide toes where movement is characterized by earth flow. Typically associated with low-strength clay in the Tropic, Dakota, and Cedar Mountain(?) Formations. Landslide features such as scarps and slide blocks are morphologically distinct; deposits may deflect stream flow and offset road alignments. Estimated to be less than 50 feet (15 m) thick.
- Qmsy Younger mass-movement deposits (slides and slumps) (Holocene to upper Pleistocene?) -
- Masses of rock and unconsolidated material that have undergone translational and/or rotational downslope movement. Similar character and occurrence as Qmsh, but landslide features such as scarps and slide blocks are morphologically less distinct as the result of weathering and erosion. May include deposits having local historical (reactivated) movement. Estimated to be less than 50 feet (15 m) thick.
- Qmso Older mass-movement deposits (slides, slumps, and flows) (Pleistocene) -- Masses of rock and unconsolidated material that have undergone translational and/or rotational downslope movement. Similar character and occurrence as Qmsy, but landslide features such as scarps and slide blocks may be morphologically subtle or indistinguishable. Includes large, deep-seated bedrock landslides and composite slide/flow landslides. May be as much as 100 feet (30 m) thick.
- Qmfy Younger mass-movement deposits (flows) (Holocene) -- Unsorted, nonstratified deposits of clay, silt, sand, gravel, cobbles, and boulders; include clast-supported debris-flow and debris-flood deposits and matrix-supported earth-flow deposits. Deposits typically form levees and elevated surfaces within and adjacent to modern stream channels. Thickness less than 10 feet (3 m).
- Qmfo Older mass-movement deposits (flows) (upper Pleistocene?) -- Unsorted, nonstratified, typically matrix-supported debris-flow or earth-flow deposits of clay, silt, sand, gravel, and scattered cobbles and boulders. Typically associated with low-

strength clay in the Tropic, Dakota, and Cedar Mountain(?) Formations. Estimated to be less than 50 feet (15 m) thick.

- Qer Mixed eolian and residual deposits (Holocene) -- Yellowish-brown, windblown, well-sorted fine sand with scattered yellowish-brown to gray, residual, subrounded gravel and cobbles of sandstone derived from the Straight Cliffs Formation. Occurs as sheets and fill in shallow topographic depressions on mesa tops. Thickness 0 to 2 feet (0-0.6 m).
- Qre Mixed residual and eolian deposits (Holocene to Pleistocene) -- Reddish-brown, residual silt and fine sand with scattered subangular gravel derived from the Crystal Creek Member of the Carmel Formation. Partly reworked by eolian processes. Occurs as a thin (0-2 feet [0-0.6 m]) mantle on top of the Co-op Creek Limestone Member.
- Qst Spring tufa (Holocene) -- Gray, white, and tan, blocky, calcareous sinter that forms small, earthy mounds; porous, contains abundant root casts. Two small deposits are mapped in the southeastern part of the quadrangle.
- Qsm Spring mud (Holocene) -- Brown, greenish-gray, and dark brown clay and organic mud with surface encrustation of white evaporite. Estimated to be less than 15 feet (5 m) thick.
- Qf Road-embankment fill (Historical).

Unconformity

Cretaceous

Straight Cliffs Formation (Upper Cretaceous) -- 980 to 1,140 feet (299-348 m) thick; uppermost beds eroded.

- Ksu Upper unit -- Slope and ledge-forming sandstone, siltstone, shale, and minor conglomerate. Sandstone is subarkosic, light gray, brown, and pale orange, typically trough cross-bedded; poorly exposed conglomerate, in lower part of unit, is limonite-stained pebble conglomerate to gritstone with clasts of chert, quartzite, siltstone, and minor basalt; variegated shale near top of unit is maroon and greenish gray; unit thickness 700+ feet (213+ m). Interpreted to be correlative with Smoky Hollow and John Henry Members of the Straight Cliffs Formation in the Kaiparowits Plateau (Peterson, 1969). Basal contact placed at top of coquinooid oyster bed that overlies cliff-forming sandstone of the Tibbet Canyon Member.
- Kst Tibbet Canyon Member -- Predominantly cliff-forming sandstone, quartzose, light

gray to grayish orange, medium to thick bedded with local low-angle cross-beds; interbedded with shale, mudstone, and silty to sandy limestone. Fossils include pelecypods, ammonoids, and bioturbation features. Unit thickness 280 to 440 feet (85-134 m). Basal contact gradational, placed at base of lowermost, laterally continuous cliff-forming sandstone.

Kst(s) Tibbet Canyon Member, slumped -- Large, relatively coherent bedrock blocks (bedding relatively well preserved) that have moved downslope under the influence of gravity. Possibly as much as 200 feet (61 m) thick.

Kt Tropic Shale (Upper Cretaceous) -- Slope-forming, thin-bedded, sandy shale and mudstone with minor sandstone and limestone; brown to gray, weathers to yellowish gray; septarian nodules weather out of thin limestone bed near base; 300 to 650 feet (92-198 m) thick. Locally includes sandstone of overlying Straight Cliffs Formation that grades into and intertongues with upper part of Tropic Shale. Basal contact placed at top of thin (4 feet [1.2 m]) coal-sandstone couplet that directly overlies the “sugarledge sandstone” of Cashion (1961).

Dakota Formation (Upper Cretaceous) -- 520 to 780 feet (159-238 m) thick.

Kdu Upper member -- Interbedded, slope and ledge-forming sandstone, siltstone, mudstone, shale, and coal. Sandstone is light brown, gray, and white, arkosic to quartzose, thin to thick bedded, planar; abundant pelecypod (*Inoceramus*) casts in upper part of unit. White, ledge-forming sandstone 25 to 50 feet (8-15 m) thick at top of unit corresponds to the “sugarledge sandstone” of Cashion (1961). Siltstone, mudstone, and shale are gray to dark gray, typically organic. Coal occurs as scattered seams 1 to 2 feet (0.3-0.6 m) thick. Unit thickness 200 to 290 feet (61-88 m). Basal contact placed at top of upper coal zone of main body.

Kd Main body -- Interbedded, slope-forming claystone, siltstone, shale, and ledge-forming sandstone. Claystone is gray to brown, locally smectitic; siltstone is dark brown to black, typically with abundant organic debris; shale is gray to dark gray, locally bentonitic or carbonaceous; sandstone is light brown to gray, resistant, locally trough cross-bedded. Coal occurs within two laterally persistent zones at the top and base of the unit, respectively. Unit is poorly exposed and involved in widespread landsliding. Unit thickness 350 to 480 feet (107-146 m).

Kcm Cedar Mountain(?) Formation (Lower Cretaceous) -- Gray to variegated mudstone overlying interbedded pebble conglomerate and conglomeratic sandstone. Mudstone is smectitic and locally contains white carbonate nodules. Basal

conglomerate is typically cliff-forming and contains well-rounded clasts of quartzite, chert, and limestone, as well as petrified wood that includes silicified logs; local uranium mineralization. Basal conglomerate thickness ranges from 8 to 120 feet (2-37 m); formation is 80 to 220 feet (24-67 m) thick. Basal contact is sharp and uneven.

Kcmc Conglomerate member (Lower Cretaceous) – Basal conglomerate is mapped separately where outcrop thickness and extent allow.

K Unconformity

Jurassic

Carmel Formation (Middle Jurassic) -- 700 to 900 feet (214-275 m) thick.

- Jcw Winsor Member -- Slope-forming, mostly reddish-brown, fine-grained sandstone, siltstone, and minor shale; upper part of member is pale-yellow, friable, fine-grained silty sandstone. Thickness 180 to 280 feet (55-85 m).
- Jcp Paria River Member -- Slope-forming, light gray to yellowish-gray, thin-bedded, platy limestone underlain by shaly limestone and sandstone, in turn underlain by cliff-forming, white gypsum (alabaster) bed. Thickness 60 to 100 feet (18-31 m).
- Jcx Crystal Creek Member -- Slope-forming, thin to medium-bedded, “banded” reddish-brown and light gray fine-grained sandstone and siltstone; local gypsum veinlets and thin beds. Thickness 160 to 220 feet (49-67 m).
- Co-op Creek Limestone Member -- Interbedded light blue-gray to pale orange, micritic to oolitic, locally fossiliferous, thin to thick-bedded limestone, calcareous and argillaceous shale, platy limestone, and minor dolomite and sandstone. Fossils include pelecypods, gastropods, and crinoid columnals (*Pentacrinus*). Member thickness 240 to 350 feet (73-107 m). Divided into upper and lower units.
- Jccu Upper unit -- Ledge-forming, thin to medium-bedded, white-weathering, micritic limestone and minor shale. Thickness 80 to 110 feet (24-33 m).
- Jccl Lower unit -- Slope-forming, calcareous and argillaceous shale and platy limestone with light-gray, thick-bedded limestone, sandstone, and siltstone at base. Basal contact is sharp and marked by a red shaly zone that overlies sandstone of the White Throne Member of the Temple Cap Formation. Thickness 160 to 220 feet (49-67).

J-2 Unconformity

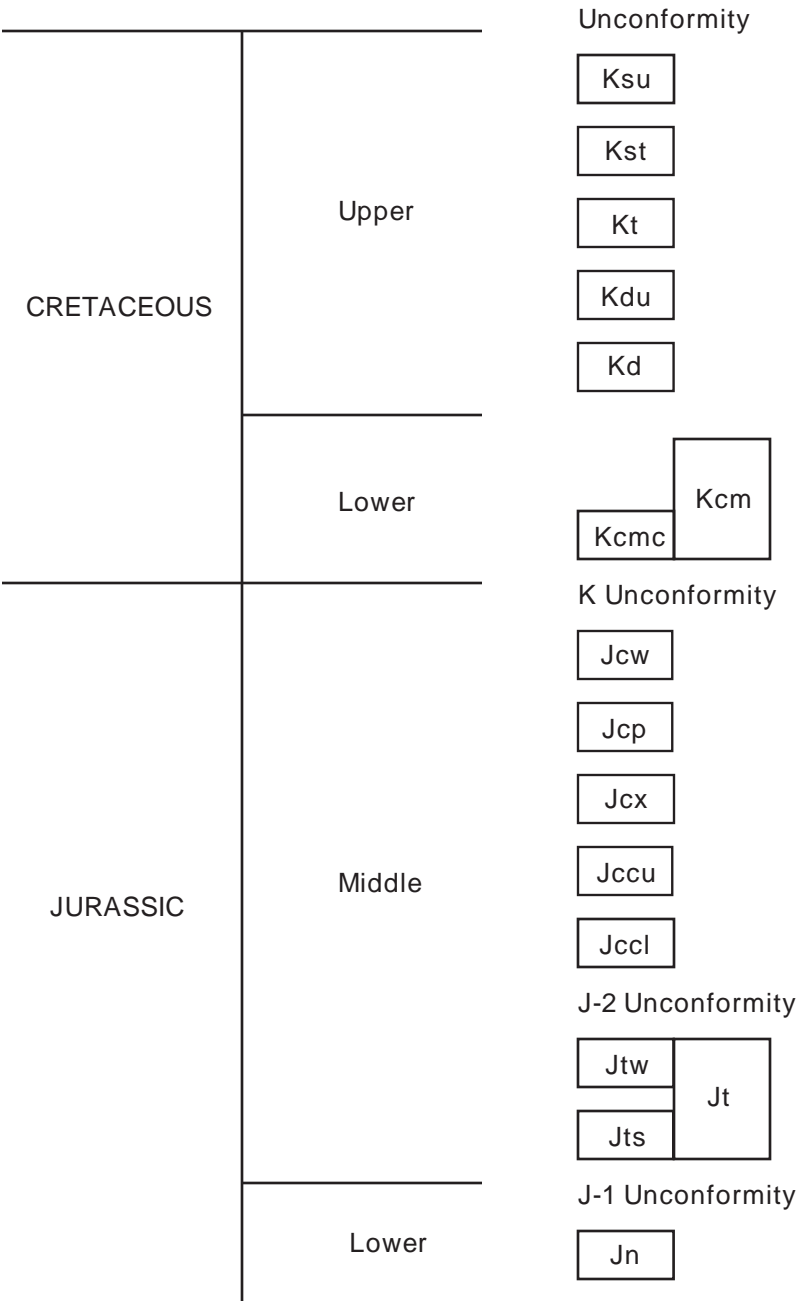
- Jt Temple Cap Formation (Middle Jurassic) -- cross section only; about 220 feet (67m) thick. On map, Temple Cap is divided into White Throne and Sinewava Members.
- Jtw White Throne Member -- Cliff-forming sandstone; light gray to pale orange, massive, with high-angle, thick cross-bed sets similar to those in Navajo Sandstone; 60 to 165 feet (18-50 m) thick. Basal contact is gradational with underlying Sinawava Member.
- Jts Sinawava Member -- Slope-forming, interbedded sandstone, siltstone, and mudstone; reddish-orange to reddish-brown; 40 to 90 feet (12-27 m) thick. Basal contact is sharp and planar.

J-1 Unconformity

- Jn Navajo Sandstone (Lower Jurassic) -- Cliff- and steep-slope-forming sandstone; very light gray to pale orange, quartzose, fine to medium grained, well sorted, massive; moderately well indurated, in part with calcareous cement; large-scale tabular- and wedge-planar cross-beds and thick cross-bed sets. Only upper 200 feet (61 m) exposed in quadrangle.

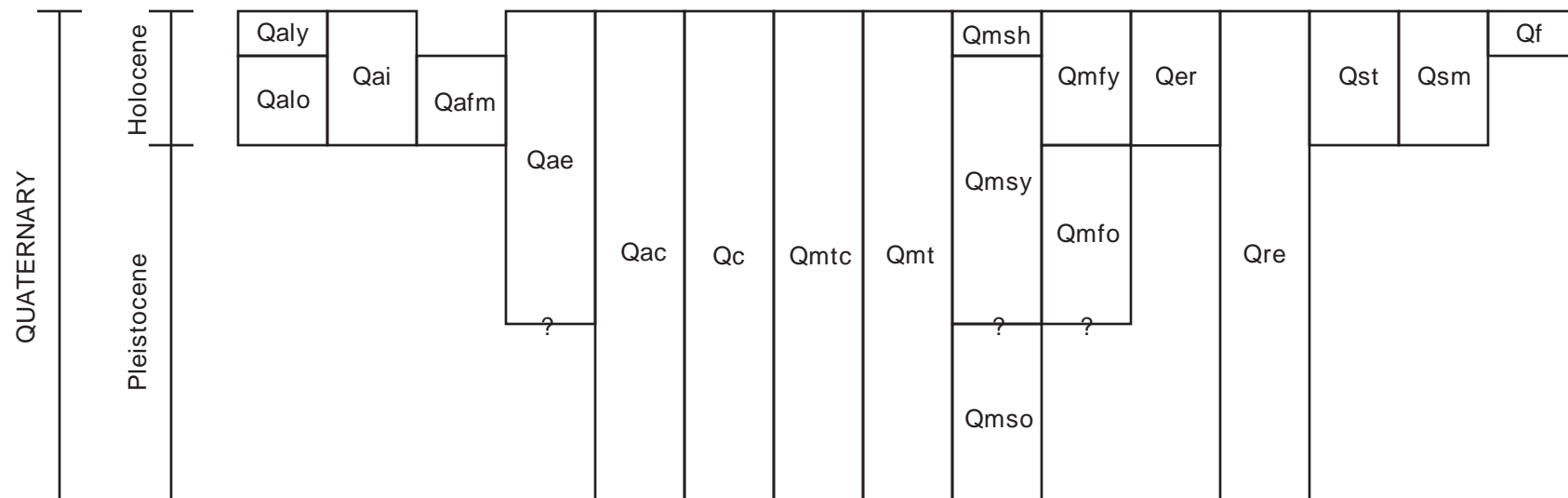
CORRELATION OF BEDROCK UNITS

CLEAR CREEK MOUNTAIN QUADRANGLE













CORRELATION OF QUATERNARY UNITS


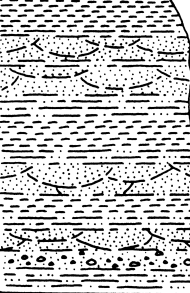


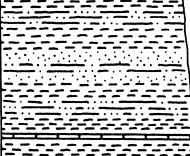



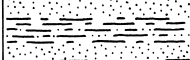

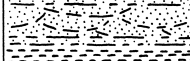
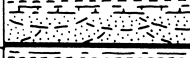
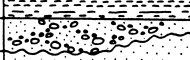



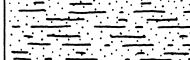

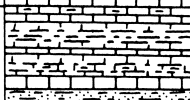
CLEAR CREEK MOUNTAIN QUADRANGLE



MAP SYMBOLS

CLEAR CREEK MOUNTAIN QUADRANGLE

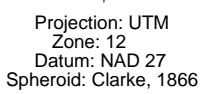
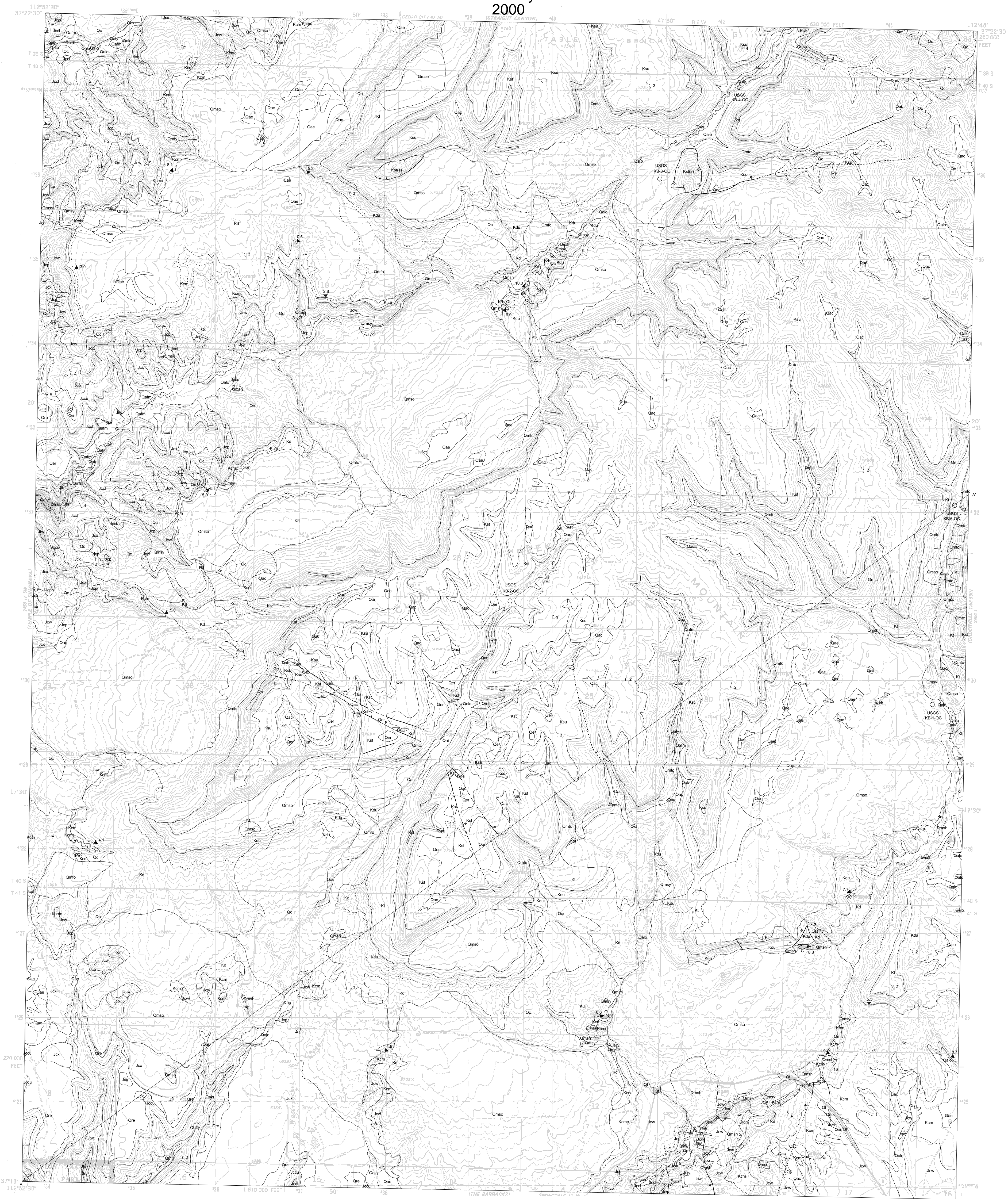
	Geologic contact; dashed where approximately located.
	Fault; dashed where approximately located, dotted where concealed; bar and ball on downthrown side.
	Surface trace of low-angle slip surface beneath gravity-slide block.
	Strike and dip of beds (field measured).
	Strike and dip of beds (calculated from three-point solution on analytical stereoplotter).
	Landslide scarp.
	Mine; C = coal, U = uranium.
	Gravel pit.
	Coal bed thickness measurement (feet).
	USGS coal-exploration drill hole (approximately located) reported in Bowers and Strickland (1978).
A ————— A'	Line of cross section.

SYSTEM	SERIES	FORMATION, member, unit		SYMBOL	THICKNESS feet (meters)	LITHOLOGY	
CRETACEOUS	QUATERNARY	Surficial deposits		Q	0-100+ (0-31)	 variegated shale	
	Upper	STRAIGHT CLIFFS FORMATION	Upper unit	Ksu	700+ (213+)	 limonite-stained conglomerate	
			Tibbet Canyon Mbr	Kst	280-440 (85-134)	 vertical cliffs	
						 resistant, CaCO ₃ -cemented interbeds	
		TROPIC SHALE		Kt	300-650 (92-198)	 septarian nodules	
		DAKOTA FORMATION	<u>"Sugarloaf sandstone"</u>	Kdu	200-290 (61-88)	 coal white sandstone	
			Upper member			 coal	
			Main body	Kd	350-480 (107-146)	 Ophiomorpha	
		 upper coal zone of Cashion (1961)					
	Lower	CEDAR MOUNTAIN FM		Kcm	80-220 (24-67)	 poorly exposed, numerous landslides	
Conglomerate member		Kcmc	8-120 (2-37)	 bentonitic shale			
JURASSIC	Middle	CARMEL FORMATION	Winsor Member	Jcw	180-280 (55-85)	 lower coal zone of Cashion (1961)	
			Paria River Member	Jcp	60-100 (18-31)	 petrified wood, local uranium	
			Crystal Creek Member	Jcx	160-220 (49-67)	 pale-yellow sandstone	
			Co-op Creek Limestone Member	Upper unit	Jccu	80-110 (24-33)	 "chippy" limestone
				Lower unit	Jccl	160-220 (49-67)	 alabaster
			TEMPLE CAP FORMATION	White Throne Member	Jtw	60-165 (18-50)	 "banded" sandstone
		Sinewaava Member		Jts	40-70 (12-21)	 Pentacrinus	
		Lower	NAVAJO SANDSTONE		Jn	200+ (61+)	 J-2 red marker J-1 vertical cliffs

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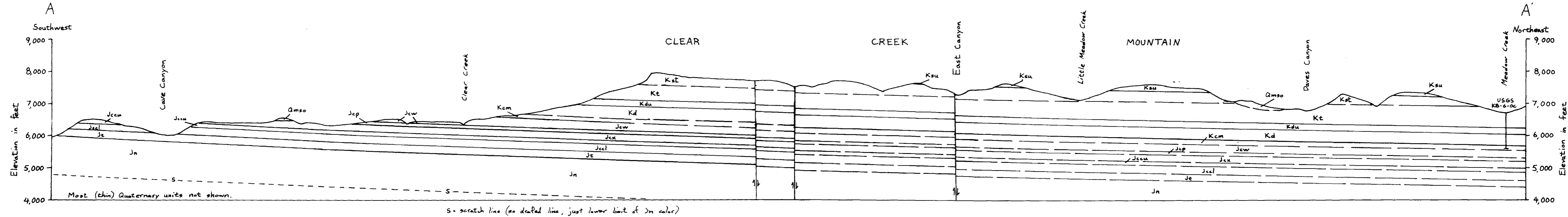
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Interim Geologic Map of the Clear Creek Mountain Quadrangle



Projection: UTM
Zone: 12
Datum: NAD 27
Spheroid: Clarke, 1866

GIS preparation by Denise Y.M. Laes and Kent D. Brown

NOT TO EXACT SCALE



Clear Creek Mountain 7.5' quadrangle

